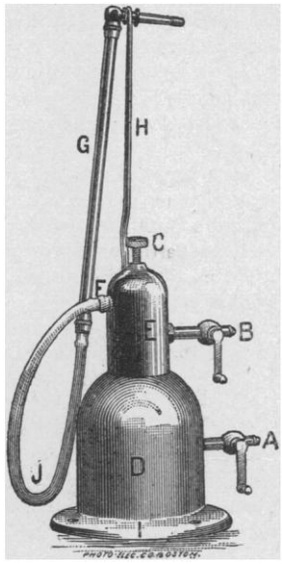
The apparatus is so designed and constructed that it will take the necessary supply of nitrous oxide from the ordinary gasometer at low pressure, or from a gas cylinder at high pressure, and economically combine it with ordinary illuminating-gas in any desired proportion for producing and maintaining a flame of the requisite intensity.

In construction, the apparatus is simple and easily understood. It consists of an expansion-chamber or reservoir, *D*, provided with a lever stop-cock *A*, which is to be connected wtth the nitrous-oxide supply at the gasometer or cylinder by strong rubber tubing.



HARWOOD'S NITROUS-OXIDE BLOW-PIPE.

Above this reservoir is the mixing-chamber, *E*, with a lever stop-cock, *B*, to be connected by rubber tubing with the illuminating-gas supply. The expansion-chamber or reservoir is separated from the mixing-chamber by a diaphragm, which is provided with a regulating-valve, the stem of which projects upward through the mixing-chamber. By means of the small hand-wheel, *C*, on this stem, the admixture of the two gases may be perfectly controlled. The combined gases are conducted through the outlet *F*, and flexible tubing *J*, to the blow-pipe tube *G*. This tube is provided with interchangeable nozzles, by means of which either a large or a small flame may be secured. When not in use, the nozzle is supported by the curved wire standard *H*. The flange *I* is drilled for screws, by which the apparatus may be secured in any convenient position to the wall or to a shelf or bench.

BELLITE.

ON Tuesday, Feb. 5, a series of experiments were made at Chadwell Heath, England, with the new explosive, bellite, invented by Mr. Carl Lamb. A description of these experiments is given in *Engineering* of Feb. 8, 1889. Reference is also made to this explosive in the same journal for July 1, 1887, and in that for Nov. 9, 1888. The new series of experiments were fully as successful as those described in these articles, and the absolute safety of the new explosive has now been placed beyond cavil. The experiments were arranged in groups, each of which was intended to illustrate either a distinguishing characteristic of bellite or its adaptability to some specified end. The first experiment was intended to exemplify its use in submarine mining: 1½ pounds of the material was enclosed in a tin canister, and, on being fired by a detonator, the explosion sent the spray fully 150 feet high. The next group of experiments were made with the object of showing the perfect safety of the material, and that it could only be fired by a detonator. A bellite cartridge was broken in two, and one half thrown on a fire, where it slowly burnt away with a reddish flame: the other half, weighing about 2 ounces, was then exploded on a wrought-iron plate 12 inches by 12 inches by ⅜ of an inch thick, the charge being tamped with clay. The shock bulged the plate to a depth of about 2 inches, but did not pierce it. An even more convincing proof of its safety was afforded by the chairman of the company, who, holding part of a naked bellite cartridge in one hand, calmly applied a lighted fusee to the fragment with the other. The bellite charred and smouldered, but went out immediately on removing the match. The next experiment was a repetition, on a somewhat smaller scale, of one of the Middlesbrough experiments, described in the second of the articles quoted above. An iron weight, weighing 120 pounds, was dropped from a height of 18 feet on to a number of naked bellite cartridges supported on an iron plate. The test was repeated twice, as on the first occasion the weight fell somewhat to one side; but on the second trial, with more careful centring, the mass of bellite was crushed to a powder. This test was much less severe than the Middlesbrough one, when the weight was half a ton, and fell from a height of 20 feet; but a heavy weight of this character is not easily moved from place to place, and hence the reason for the lighter one. A small canister capable of holding 5 ounces was then filled with the fragments resulting from the last experiment, and laid on the web of an old Great Eastern Railway Company's steel-faced rail, the charge being slightly tamped with clay. On firing, the rail was snapped in two, a piece about 1 foot long being flung 6 yards, and smaller fragments much farther, while a pit 15 inches deep was sunk in the ground immediately underneath the position of the charge.

The next experiment was a repetition of one first made at one of the collieries of South Wales. In it 1 pound of ordinary blasting-powder and 1 pound of naked bellite cartridges were placed together in an open pit 1 foot 10 inches deep, and the powder ignited. Some pieces of the bellite were thrown out of the hole, and all were slightly charred, but none of it exploded.

To further illustrate the safety of the material, a fragment of bellite was fired from a large-caliber gun (No. 8) with two drams of powder, against an iron plate, without any explosion of the bellite occurring either in the bore of the gun or on striking the target. This experiment would, moreover, seem to prove that bellite is well adapted for use in shells, and the English Government is accordingly to be congratulated on not having spent large sums in acquiring the secret of melinite. It had been the intention of the experimenters to fire a bullet from the same gun at a target formed of bellite cartridges backed by an iron plate; but, owing to the jamming of a cartridge in the gun, this experiment had to be abandoned.

To compare the effects of bellite with those of dynamite, 2 ounces of each explosive were fired on wrought-iron plates measuring 12 inches by 12 inches by ⅜ of an inch thick; each plate, with the object of rendering the conditions as uniform as possible, being supported above the ground by a narrow cast-iron ring about $\frac{5}{16}$ of an inch thick, 3 inches high, and 11 inches internal diameter, the charge in each case being tamped with clay. Both plates were pierced through, but the rents in the one on which the dynamite had been fired were considerably larger, while, on the other hand, the bulge in this plate was only 2½ inches deep, as compared with 3 inches in the case of the other, thus showing the action of the dynamite to be more local.

The next series of experiments were made with a view to showing the adaptability of bellite to military purposes. To this end the ballistic properties of bellite and Curtis and Harvey's rifle-powder were first compared; a 6-inch ball, weighing 32 pounds, being fired from a mortar, first with ½ ounce of powder, and, second, with ¼ ounce of bellite, the weighings being carefully made in the presence of two representatives of the press. With the powder, the ball was thrown a distance of 40 yards 1 foot; and with the bellite, to a distance of upwards of 100 yards, the penetration into the ground being also much greater in this case.

Two mines had been prepared, one with 6 pounds of powder laid at a depth of 5 feet, and the other with 6 pounds of bellite laid at the same depth. In trying to explode these, however, it was found that in the passage of some of the spectators over the mine both fuzes had been pulled out from the bellite charge, and the attempt to fire it accordingly failed. A good idea of what the effects would have been was, however, gained in the next experiment, in which a mine containing 8 pounds of bellite was fired underneath a length of railway laid down for the purpose. The explosion smashed both

rails clean through, and several of the sleepers were splintered, a large piece of one being flung fully 40 yards, while the crater formed was upwards of 12 feet in diameter. This, the most striking of the experiments, was also the last.

SCIENTIFIC NEWS IN WASHINGTON.

Bibliography of the Iroquoian Languages. — The Los Angeles Base-Line. — Deep-Sea Models.

Bibliography of the Iroquoian Languages.

SOME ten years ago Mr. Pilling of the Bureau of Ethnology entered upon the formidable task of preparing a systematic and exhaustive exhibit of all printed and manuscript works giving information respecting the speech of the native races of North America. The need of such exhibit had become strikingly apparent. For nearly four hundred years information had been accumulating respecting the North American aborigines, and this accumulated information had been printed in many lands in many tongues. The subject was fast becoming, or had already become, buried in the *débris* of its own literature. Special students found themselves consuming an inordinate amount of time in acquiring even an imperfect knowledge of the literature of the special subject of their study.

Recognizing this condition, the labor of preparing a bibliography of North American linguistics was, as already indicated, systematically entered upon more than ten years ago, and has been continued with only such interruptions as were necessitated by other official duties. The work before us[1] closes the third chapter in this work.

The first chapter or division of the work was a bibliography of the Eskimo languages, issued in 1887; the second, a bibliography of the Siouan languages, issued in 1888; and the third, that of the Iroquoian, now before us; to be shortly followed by the Muskhogean, and later by the Algonquian and the Athabascan.

The aim to make the catalogue as exhaustive and complete as possible, and the dictionary plan of arrangement, carried to its extreme limit, remain the same as in the earlier bibliographies; and it may be added, that zeal in the pursuit of all information relating to the books catalogued, and fidelity in exhibiting this information, increase rather than diminish as time passes.

As a sample of Mr. Pilling's painstaking bibliographic research, the "Voyages of Baron Lathontan" may be cited. Seven pages of the bibliography are given to the careful and minute description of the eighteen editions of the work, which appeared in French, English, German, and Dutch. To collate these different editions, copies were borrowed from numerous sources, and photographs of titlepages made, that proof might be read from facsimiles. The careful scrutiny exercised in preparing these minute descriptions has developed the fact, that, from the original edition of 1703, two spurious editions of the same date were prepared. So far as ascertained, but one copy of the authentic edition is extant.

The catalogue contains in round numbers 950 titles, of which 800 relate to printed and 150 to manuscript matter. Of these, Mr. Pilling has himself seen and described 850, or 89 per cent; and of the remaining 11 per cent, about two-thirds have been seen and described for this catalogue by his correspondents. Thus about 95 or 96 per cent of the entries are at first-hand; and, further, 61 per cent of the entries were compared directly with the original sources while the proof was passing through his hands.

Of the various languages included under the general term "Iroquoian," — viz., Cayuga, Cherokee, Hochelaga, Huron, Iroquois, Maqua, Minqua, Mohawk, Oneida, Onondaga, Seneca, Tuscarora, and Wyandot, — more than half of the material catalogued relates to the Cherokee and Mohawk only; most of the Bible, for instance, having been printed in each of these languages. Printed dictionaries of the Huron, Mohawk, and Onondaga, and manuscript dictionaries of the Seneca and Tuscarora, are in existence. There are in print rather extensive grammatical treatises on the Cherokee, Huron, and Mohawk, and fragmentary grammatical notes on several of the remaining languages. Of the Cherokee texts, all except two spelling-books, published in 1819 and 1824 respectively, are in the Cherokee syllabary, these two having been printed before the invention of those characters.

The earliest printed record of any North American language appears to have been made by Cartier, whose first voyage was made in 1534, and the second in 1535. There is reason for believing that the original account of the first voyage contained a vocabulary of the people of New France; but, so far as known, no copy of this book is in existence, and the date of its publication is not known. The account of the second voyage was published at Paris in 1545, and contains a Huron vocabulary.

This is one of the rarest books in the entire list, only two copies having been known for the last three hundred years. Of these, one was bought in 1851, and lost in a ship on its way to America. The other and only known copy is in the British Museum. Of this "unique," Mr. Pilling gives a facsimile of the titlepage. Facsimiles are also given of several other rare, curious, or specially interesting books.

The work contains eight pages of addenda, which accumulated while the copy was in the printer's hands.

A chronologic list of authors at the end of the volume, covering eighteen pages, begins with Cartier in 1545, and ends with a list of nearly forty works issued in 1888. From an inspection of this list, it appears that interest in matters relating to the Iroquois was never greater than at present; and, while the literature of the subject has been accumulating during the past three hundred and forty years, more than half of it has appeared within the last forty.

[1] Bibliography of the Iroquoian Languages, by James Constantine Pilling.

The Los Angeles Base-Line.

The "Yolo Base," as it is familiarly known to geodesists, being the base-line measured in Yolo County, Cal., in 1881, for the transcontinental triangulation of the United States Coast and Geodetic Survey, was, in point of rapidity and accuracy of measurement, the best work of the kind ever performed. That measurement was made under the immediate supervision of Professor George Davidson, assistant United States Coast and Geodetic Survey, with the five-metre compensating base apparatus, which had been constructed at the office of the survey in Washington, under the supervision of Assistant C. A. Schott, and in accordance with a design prepared and submitted by him. The length of the "Yolo Base" was 17,486.5119 metres (10.86 miles). It was measured twice throughout its entire length, with a third measurement covering less than half (42.8 per cent) of its length. The two measurements and partial measurement occupied a total of forty-six days.

The recent measurement of a Coast and Geodetic Survey base-line near Los Angeles, Cal., which was concluded on the 16th of February, afforded to Professor Davidson, under whose supervision the work was also done, an opportunity of fulfilling his announced purpose of "breaking all records" of base measurements.

The "Los Angeles Base" is roughly 17,496 metres in length, or 9.5 metres longer than "Yolo Base." Although the weather was extremely unfavorable, the work having been pushed in the frequent severe rain-storms, which converted the line into a route of deep mud, standing pools, and rushing streams, three full measurements were completed in 46.75 days, the average measurement per day having been 1,122.73 metres, against an average of 912.5 in the "Yolo Base;" the longest measurement in a single day having been 2,000 metres, against 1,620 metres on the "Yolo Base;" and the cost, exclusive of the expenses connected with the establishment of monuments at the ends of the lines, was $8,000, against $15,578 for the measurement of Yolo.

It is hardly to be expected that the accuracy of the Yolo measurement, which involved a probable error of ± 0.035 of an inch per statute mile, or .38 of an inch in a length of 10.8657 miles, will be surpassed by that of the Los Angeles Base. If it is even equalled, the Los Angeles Base measurement will signalize again the unequalled proficiency of American officers.

Deep-Sea Models.

Mr. E. E. Court of the Hydrographic Office of the Navy Department has published two excellent models, — one of the Atlantic Ocean, the other of the Caribbean Sea. These accurate and neatly finished models convey an excellent idea of the configuration of the bottom of the sea which is only inadequately expressed to the in-